# Monitoring of the bark-beetle disaster in the Czech forests

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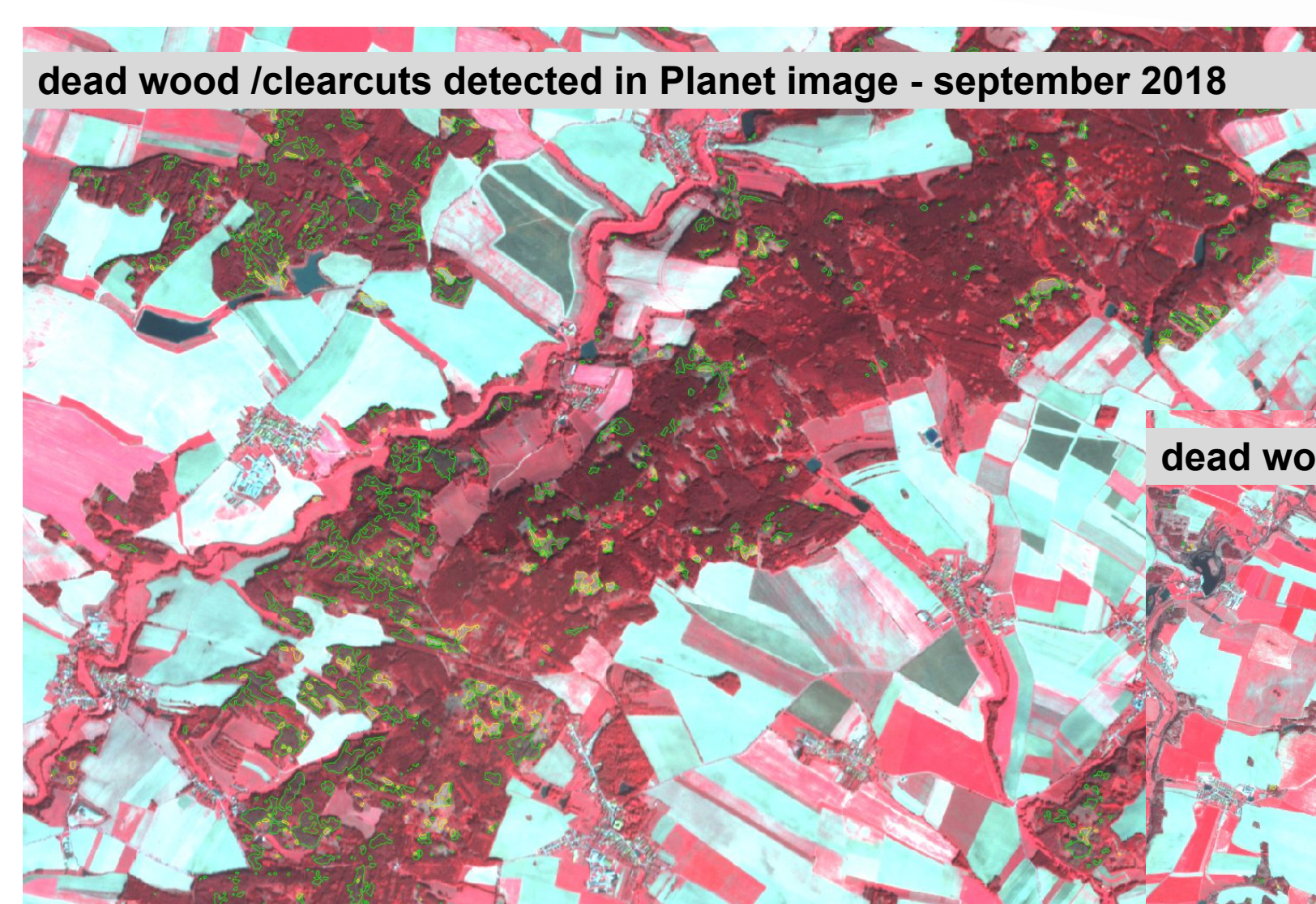
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The monitoring of the coniferous forests affected by the actual bark-beetle disaster is based solely on the remote sensing image analysis techniques. The resulting bark beetle infestation map is a GIS thematic layer classifying the Norway spruce (Picea Abies) forests based on the automated analysis of the vegetation indices from the PlanetScope satellite imagery covering the entire territory of the Czech Republic. Beside the Planet images, there are two important input data sources provided by the Remote Sensing department of the Forest Management Institute branch in Frýdek-Místek: 1) Actual coverage of the coniferous forest stands - based on the Map of tree species of the Czech republic created at FMI in 2019 and the forest stand heights derived from the aerial stereo-image matching (nDSM) from national aerial imaging campaign of the State Administration of Land Surveying and Cadastre (ČÚZK), and 2) Actual distribution of clearcuts prior to 2018 - based on the time-series analysis of the change in leaf area index product developed by the FMI for Czech forests using the Sentinel-2. The Planet imagery were used for timely detection of recent sanitary loggings as a result of bark beetle-induced tree mortality as well as detection of dead standing wood in the forest which has to be removed from the forest during winter months. The result is being periodically updated since September 2018 and published (www.kurovcovamapa.cz and www.uhul.cz) three times a year.
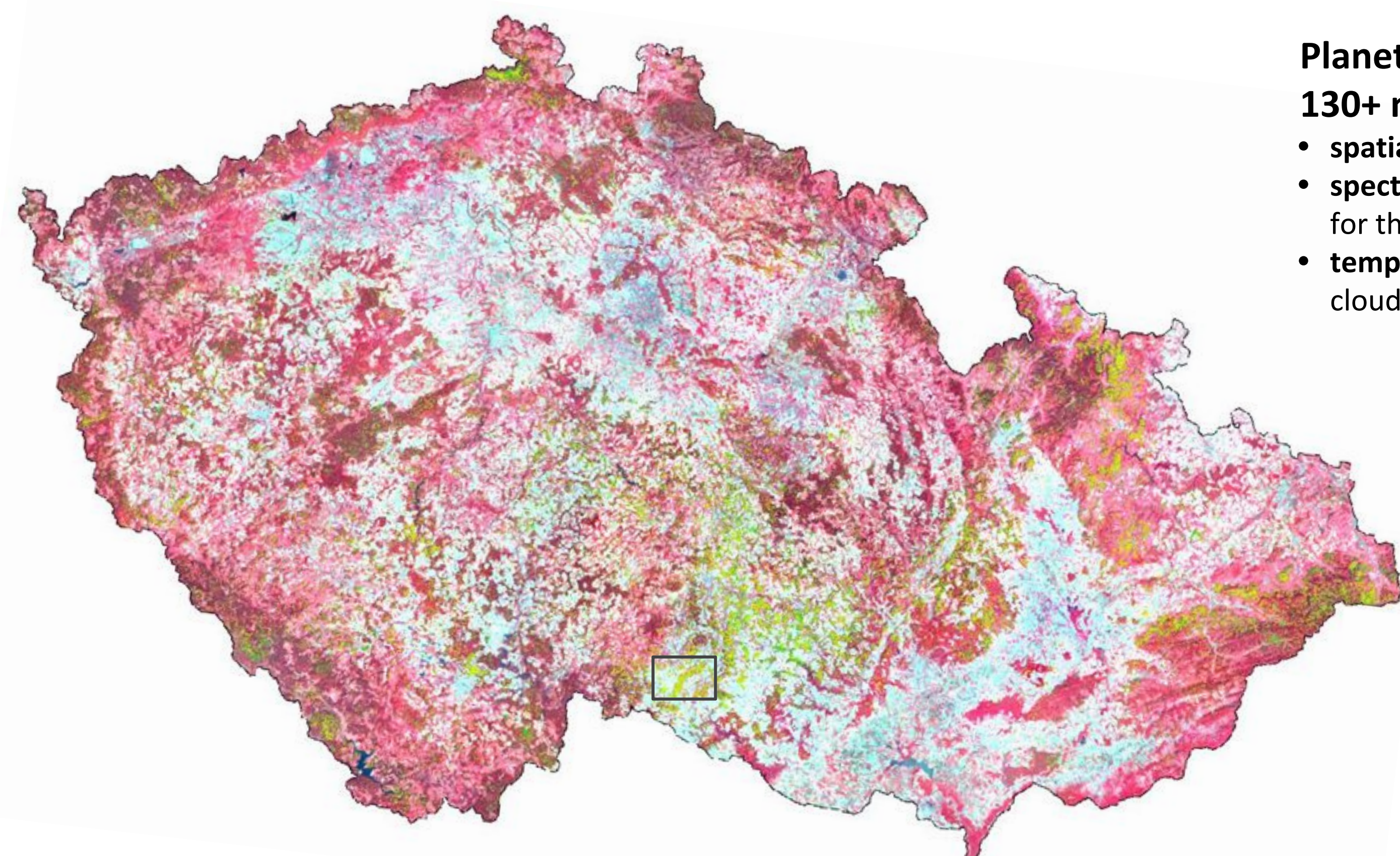
PlanetScope - a commercial Earth observation system formed by the constellation of 130+ microsatellites
- **spatial resolution** 4,7 m/ pixel - sufficient spatial detail for the analysis on the level of individual trees
- **spectral resolution** RGB+NIR - limited comparing to Sentinel-2 with absence of the spectral information for the vegetation health status
- **temporal resolution** is outstanding with possibility of 12 full country coverage mosaics /year (3 - 4 cloudfree mozaics / year with Sentinel-2)

dead wood forest stands detected in Planet imagery

normalised Digital Surface Model from aerial images

Map of forest tree species derived from Sentinel-2

Object-based image analysis of vegetation indices NDVI and TGI on area of coniferous forest stands

dead wood /clearcuts detected in Planet image - september 2018

dead wood /clearcuts detected in Planet image - september 2019

In period September 2018 - September 2019:
- **37 000 ha** of detected clearcuts
- **10 000 ha** of standing dead wood
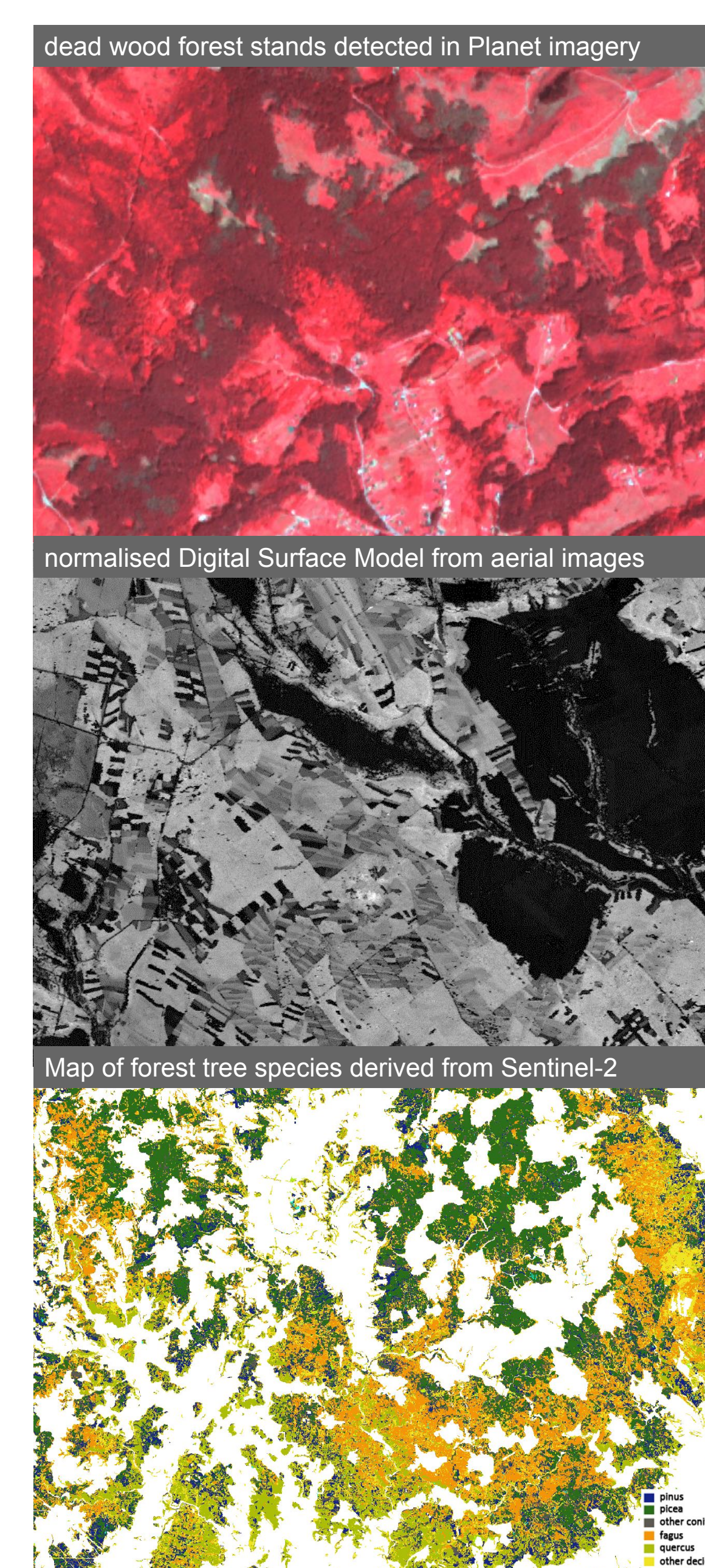
According to those maps the Ministry of Agriculture of Czech Republic issued a „Public decree" (legislation instrument to help forest owners by reducing the regulation of their obligations under the Czech forest law so that they can manage the bark beetle calamity) in April 2019 and updated on September 2019 and on December 2019.
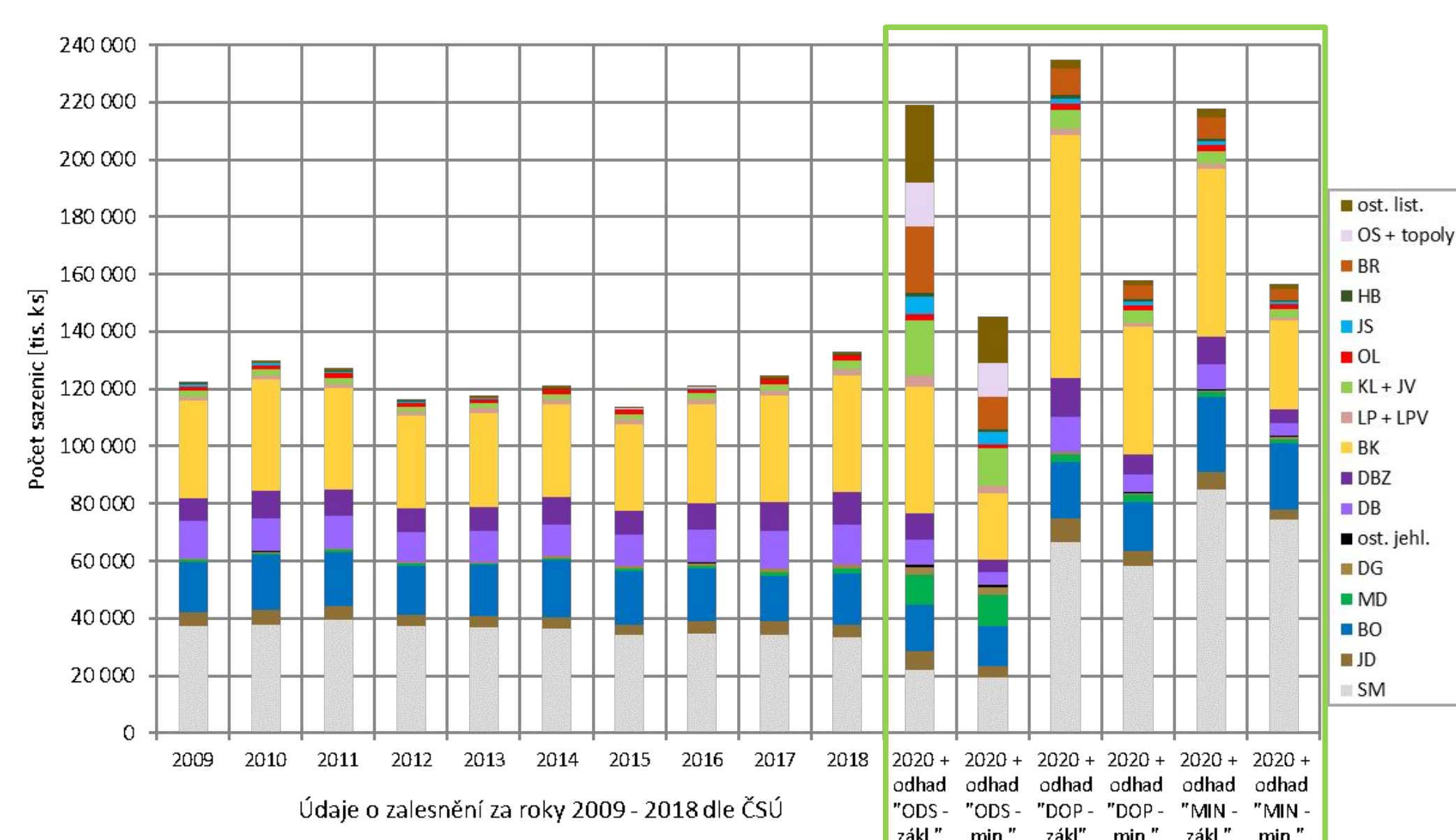
The thematic maps are also used to compile a guidebook so called **General Plan for forest regeneration after a bark beetle calamity**. The chart shows numbers of seedling of various forest species estimated according to the area of clearcuts detected in five different scenarios.